



TARDEC Technical Director (Acting) Dr. Marilyn Freeman

presentation on
Force Protection

to the
**Science & Engineering Technology
Conference**



SUPERIOR TECHNOLOGY



TARDEC

U.S. ARMY TANK AUTOMOTIVE RESEARCH, DEVELOPMENT AND ENGINEERING CENTER

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Outline

Perspectives:

- ***Science & Technology***
- ***Survivability***

Survivability:

- ***Recent Past***
- ***Present***
- ***Future***

Responding to Army Needs

30 June 2003
CHANGE 2 to
TRADOC Pamphlet 525.3-90 O&O
The United States Army

“...become a more strategically responsive, deployable, agile, versatile, lethal, survivable, and sustainable force, effective in all situations ...”

Oper

**Army Strategic
Planning Guidance
2006-2023**

“...provide relevant and ready land power capability to the Combatant Commander as part of the Joint Team”

**UNITED STATES ARMY
2004 ARMY
TRANSFORMATION
ROADMAP**

“...provide dominant land power to the Joint Force now and into the future.”

**UNITED STATES ARMY
SERVING
a NATION
at WAR**

“...change in time of war must deal simultaneously with both current and future needs”



Army S&T Vision: Pursuing Transformational Capabilities for a Joint and Expeditionary Army

Current Force



~100 lb. load



70+ tons



< 10 mph

Enabling the Future Force

Science and Technology—develop and mature technology to enable transformational capabilities for the Future Modular Force while seeking opportunities to accelerate technology directly into the Current Modular Force

Enhancing the Current Force

< 40 lb.
load



Fully networked



< 30 tons

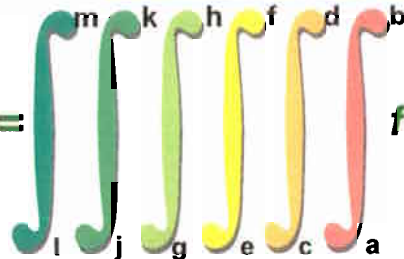


> 40 mph



What is Survivability?

Survivability =



$f(\text{Armor})dxdt + f(\text{APS})dxdt + f(\text{Electronic Warfare})dxdt + \dots$



$\dots + f(\text{Signature Mgt})dxdt + f(\text{Countermine})dxdt + \dots$

$\dots + f(\text{Damage Mitigation})dxdt + f(\text{Lethality})dxdt + \dots$

$\dots + f(\text{Unmanned Platforms})dxdt + f(\text{TTPs})dx + \dots$

$\dots + f(\text{Platform Design})dx + f(\text{Mobility})dxdt + \dots$

Survivability 'Onion'



Technologies: Recent Past & Present



**Multi function OTM
Secure Adaptive
Integrated Comms**



FCS C2



**Networked
Communications**



**Mid Range
Munition**



**Compact
KE Missile**



**Precision
Attack Msl**



**Loiter Attack
Msl**



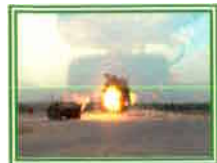
CAT VTI Test bed



**SATCOM On
The Move**



**Close-in Active
Protection Sys (APS)**



**On The
Move APS**



Adv Armor



KE APS



Change Detection



UGV



Spinner-Mobility



LtWt 120mm Gun



Auto Loader



Hummingbird



MAV 6/11



Technologies for the Current & Future Force



Soldier Protection Technologies Individual Soldier Ballistic/Blast Protection



- The Warfighter continues to face a significant threat from multiple threats including ballistic and blast
- Personnel armor plays an important role in the survival of our Warfighters
- Soldier Protection Technologies are responding to capability requirements and address the need for:
 - Lightweight protective materials technology that improve the survivability of the individual warfighter against a full spectrum of ballistic and blast threats
 - Tools that provide "leap-ahead" capability to assess individual survivability and munitions lethality





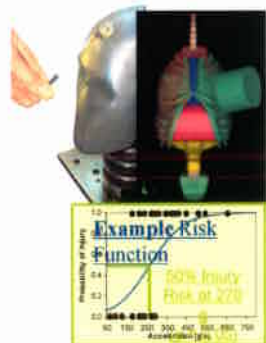
Soldier Protection Technologies

Individual Soldier Ballistic/Blast Protection



Key Focus Areas for Research and Development

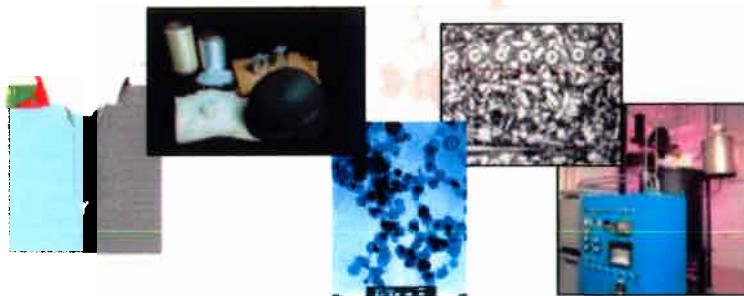
Behind Armor Effects Methodology



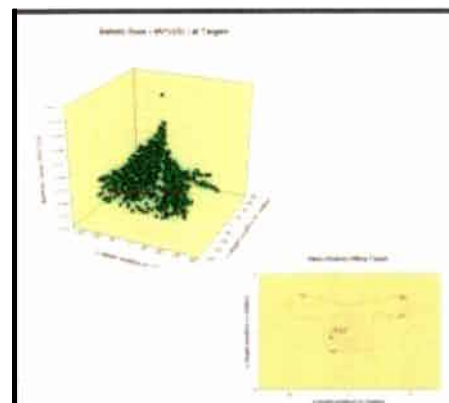
Conduct experimental (tissue & test fixture), analytical and numerical assessments of non-penetrating impact on body armor/body

Advanced Technology Development

- New high performance polymers/ fibers/composites
- Nanotechnology
- Advanced ceramics & metals
- Enhanced predictive modeling
- Material systems integration



Casualty Reduction Analysis Model



Develop/update models for armor system performance from threat definition to incapacitation effect



Survivability Technologies: Recent Past & Present

Army Science Board, 2001:
Active Protection Systems (APS) will not be able to achieve
their objectives

Significant Strides:



IAAPS: Defeat On-the-move



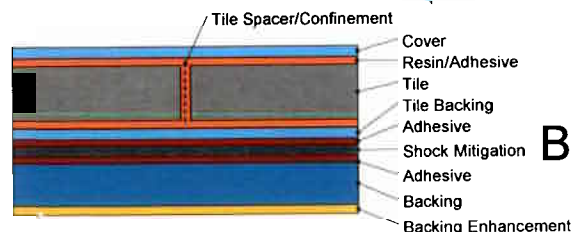
CIAPS: Dual defeat On-the-move



FCLAS: Threat defeat demonstrated



EM Armor: Multiple defeats on single panel



Ballistic Armor: 225 psf down to 64 psf



“Come a long way in a short time”

9/11

TARDEC



Influences that Drive Our Path Forward

- ***As a result of today's world situation: There is not only technology push, now there is current demand - particularly for survivability***
- ***Current Threats apply not only for Light, Medium & Heavy Combat Vehicles but for Light, Medium & Heavy Tactical Vehicles and unmanned systems***
- ***Emerging Requirements***
- ***Application of Survivability Technologies***
 - ***Address IED protection***
 - ***Integration onto Platforms***
 - ***Address Safe & Arm issues***
 - ***Right mix on Platform***
 - ***Address Fratricide issues***
 - ***Tactics, Techniques & Procedures***

**Must Enable Continuous Improvement...
i.e. modularity, mission tailorability, commonality...**



How Not to Make a Lightweight Vehicle Survivable



... Adding every survivability technology available without trade-off analysis and integration considerations

Path Forward



Survivability =

- [Armor] • [APFSD] • [Electronic Warfare] • ...
- [Signature] • [Countermeasures] • ...
- [Damage Mitigation] • [Lethality] • ...
- [Unmanned platforms] • [TTPs] • ...
- [Platform Design] • [Mobility] • ...

Soldier

Future Combat & Tactical Fleets

Advanced Survivability Technologies

Integrated Survivability Capabilities

Robotics

Lethality

Current Combat & Tactical Fleets

High Performance Components

Weight & Volume Efficient

Mobility



CAUTION: All along the yellow brick road we should expect signs like: STEEP GRADE; SCHOOL ZONE; LIMITED SPEED ZONE; ROAD NARROWS; STOP; WINDING ROAD; GO; DETOUR; TRAFFIC LIGHTS AHEAD; NO EXIT; NO PASSING; WRONG WAY.

There is a huge challenge before us...our work has only begun... we must find the right path to deliver and implement suites enhancing current and future platform survivability